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# Innovative Exporters and Intellectual Property Regimes in Selected Service Industries: Evidence from the Canadian Survey of Innovation 2003

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Statistics Canada
Science, Innovation and Electronic Information Division
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***Note of appreciation***

*Canada owes the success of its statistical system to a long standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.*

## *User information*

### Symbols

The following standard symbols are used in Statistics Canada publications:

| | |
|---|---|
| . | not available for any reference period |
| .. | not available for a specific reference period |
| ... | not applicable |
| 0 | true zero or a value rounded to zero |
| 0s | value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded |
| p | preliminary |
| r | revised |
| x | suppressed to meet the confidentiality requirements of the *Statistics Act* |
| E | use with caution |
| F | too unreliable to be published |

## *The science and innovation information program*

The purpose of this program is to develop useful indicators of science and technology activity in Canada based on a framework that ties them together into a coherent picture. To achieve the purpose, statistical indicators are being developed in five key entities:

- **Actors**: are persons and institutions engaged in S&T activities. Measures include distinguishing R&D performers, identifying universities that license their technologies, and determining the field of study of graduates.
- **Activities**: include the creation, transmission or use of S&T knowledge including research and development, innovation, and use of technologies.
- **Linkages**: are the means by which S&T knowledge is transferred among actors. Measures include the flow of graduates to industries, the licensing of a university's technology to a company, co-authorship of scientific papers, the source of ideas for innovation in industry.
- **Outcomes**: are the medium-term consequences of activities. An outcome of an innovation in a firm may be more highly skilled jobs. An outcome of a firm adopting a new technology may be a greater market share for that firm.
- **Impacts**: are the longer-term consequences of activities, linkages and outcomes. Wireless telephony is the result of many activities, linkages and outcomes. It has wide-ranging economic and social impacts such as increased connectedness.

The development of these indicators and their further elaboration is being done at Statistics Canada, in collaboration with other government departments and agencies, and a network of contractors.

Prior to the start of this work, the ongoing measurements of S&T activities were limited to the investment of money and human resources in research and development (R&D). For governments, there were also measures of related scientific activity (RSA) such as surveys and routine testing. These measures presented a limited picture of science and technology in Canada. More measures were needed to improve the picture.

Innovation makes firms competitive and we are continuing with our efforts to understand the characteristics of innovative and non-innovative firms, especially in the service sector that dominates the Canadian Economy. The capacity to innovate resides in people and measures are being developed of the characteristics of people in those industries that lead science and technology activity. In these same industries, measures are being made of the creation and the loss of jobs as part of understanding the impact of technological change.

The federal government is a principal player in science and technology in which it invests over five billion dollars each year. In the past, it has been possible to say only *how much* the federal government spends and *where* it spends it. Our report Federal Scientific Activities, 1998 (Cat. No. 88-204) first published socio-economic objectives indicators to show *what* the S&T money is spent on. As well as offering a basis for a public debate on the priorities of government spending, all of this information has been used to provide a context for performance reports of individual departments and agencies.

As of April 1999, the Program has been established as a part of Statistics Canada's Science, Innovation and Electronic Information Division.

The final version of the framework that guides the future elaboration of indicators was published in December, 1998 (Science and Technology Activities and Impacts: A Framework for a Statistical Information

System, Cat. No. 88-522). The framework has given rise to A Five-Year Strategic Plan for the Development of an Information System for Science and Technology (Cat. No. 88-523).

It is now possible to report on the Canadian system on science and technology and show the role of the federal government in that system.

Our working papers and research papers are available at no cost on the Statistics Canada Internet site at *http://www.statcan.ca/cgi-bin/downpub/research.cgi?subject=193*.

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# *Innovative Exporters and Intellectual Property Regimes in Selected Service Industries: Evidence from the Canadian Survey of Innovation 2003*

by Frances Anderson, Statistics Canada and Ingrid Schenk, Industry Canada

## 1 The service economy in global context: the growth of trade in services

The role of services is increasingly an important component of national economies and their competitiveness. For the Organisation for Economic Co-operative and Development (OECD) countries, service industries have become a central aspect of knowledge-based economies and contribute to over 70% of employment, employment growth and value-added (OECD, 2005). Service industries are also becoming more innovation intensive, which, along with the globalization of knowledge and trade flows, raises questions about the ways in which firms can gain and sustain competitive advantage. As a small open economy, Canada is highly dependent on trade and must continually address the means by which service sector firms can gain access to, and compete in, global markets.

Globalization is an important driving force for innovation in services. The increasing globalization of trade and the emergence of new knowledge-based industries, particularly in the area of services, might be expected to offer many new opportunities for innovation and growth. To gain and maintain competitive advantage, therefore, service firms will increasingly depend on their capacity to exploit and sustain their innovative activities in global markets.

In spite of the increasing growth and predominance of services in industrialized economies, less is known about how they are produced and there is little empirical evidence available to explain the innovation activities and the export activities of service firms. The nature of services is diverse and heterogeneous in nature both within and across service industry sectors. For policymakers, lack of a clear understanding of how service firms contribute to innovation makes it difficult to understand if services are suited to the framework conditions in operation and whether government programs support business innovation. Consequently, a better understanding of the nature of innovation in services and the types of innovative activities these firms are engaged in is needed.

To contribute to this research area, the objective of this paper is to examine the relationship between intellectual property rights and firm performance in two service industry sectors: Information and Communications Technology (ICT) and Selected Professional Scientific and Technical Services (Selected PST). Using data from the Statistics Canada's Survey of Innovation 2003 which surveyed establishments in selected service industries, we examine the innovative exporters in both these sectors. This study departs from existing empirical studies that use intellectual property protection mechanisms on an individual basis to gain insight into service firm innovation activities. Instead, we introduce the concept of an Intellectual Property (IP) regime, formal or informal, which is applied to a range of internal and external firm-specific, innovation-specific, market-specific, and firm strategy variables. By comparing the significant difference between the use of formal and informal IP regimes across a range of innovation variables for two service sector industries this study addresses the major weakness associated with identifying sectoral variations within and across service industry sectors.

In the sections that follow, an overview of the theoretical literature on service innovation and the empirical basis for the development of service indicators for innovation will be discussed. The fourth section presents a conceptual framework for analysis, the use of intellectual property protection mechanisms as a service innovation indicator in the context of the types of innovative activities being pursued by service firms in the ICT and Selected Professional Scientific and Technical service industry sectors. The data and methodology and the empirical results are then discussed. The final section presents the conclusions, limitations of the study areas for further research.

## 2 Theoretical approaches to service innovation

At present, there are three identifiable theories relating to service innovation which are captured under the categorizations of the "technological (or traditional), approach, the "service-oriented" (or Lille School) approach, and the "integrative" (or emergent/strategic positioning) approach. This initial classification was used by Gallouj (Gallouj 2002; Gallouj and Weinstein 1997). Tether (2003) also uses a similar categorization but uses the terms: traditional, Lille and emergent/strategic positioning, as denoted above respectively.

### 2.1 The 'Traditional' or 'Technology' perspective

The 'technology' perspective was perhaps the first attempt to understand service innovation. This perspective was derived from the taxonomic work done by Pavitt (1984) on sectoral patterns of technological change in manufacturing. In his work, Pavitt classified private services (both manufacturing and private services), as being supplier-dominated. In this categorization service firms were perceived as being passive adopters of externally developed technologies (Tether 2003). In this context, service firms produced goods and services that contributed to the manufacturing process or existed to serve local needs.

Early efforts to adapt this work and further refine service innovation activities were undertaken by several authors including Miozzo and Soete 2001; Pavitt, Robson, and Townsend 1989; Evangelista 2000; Barras 1986, 1990. Among these latter efforts, there was an increased recognition that services could be sources of new technologies and that some could be developed interactively between producers and consumers. Howells (2000), however, argues that despite their attempt to adapt their studies for the dynamics of the service sector, they maintained their technological or supplier-dominated focus and, therefore, tend to remain outside the services research community.

Although the next two approaches detailed below provide different perspectives, it is also worthwhile noting that research in all three areas continues (Howells 2006). For instance, Hipp and Grupp (2005) take into account that innovation and related activities are not directly transferable to services. These authors empirically test the conceptual typology of services introduced Soete and Miozzo (1989) that was adapted from the Pavitt model above. Using selected results from the Germany innovation survey in the area of knowledge intensive business services, the authors confirm the usefulness of the typology: knowledge intensity firms, network basis firms, scale intensity firms, and supplier dominance.

Unfortunately, the usefulness of this approach is limited to knowledge intensive business services (KIBS), or those service companies that demonstrate a classical innovation structure. Moreover, the use of taxonomies are limiting since they tend to present aggregate industry level analysis that presumes that innovation patterns at this level of aggregation are homogenous. A recurring theme for service innovation, however, is the level of heterogeneity between and within service industry sectors. Of interest, however, from the Hipp and Grupp (2005) study, however, is the finding of the role of the external environment in helping to define unique characteristics for service companies, a point that will be elaborated on in the integrative perspective section below.

### 2.2 The 'Service-Oriented' perspective

The central feature of the service-oriented approach to service innovation seeks to identify the distinctive differences between manufacturing innovation and service innovation.[1] According to authors in this field, service innovation differs since service firms tend to (i) produce intangible assets; (ii) are smaller in size; (iii) are less R&D intensive; (iv) rely more on human capital and knowledge assets; (v) produce services interactively, that is, through a close client-producer relationship whereby a service is produced and consumed almost simultaneously; (vi) have shorter innovation cycles; (vii) produce product/service offerings that are subject to fast change and rapid imitation; and (viii) pursue innovation that is more incremental and continuous in nature (Andersen and Howells 2000; Sundbo 1998; Sundbo and Gallouj 2000; Gallouj 2002; Gallouj and Weinstein 1997; Miles 1994; Sirilli and Evangelista 1998).

1 This approach is also referred to as the 'Lille school' since research in this area is primarily associated with work done by researchers at Lille University in France.

Using the CIS2 survey, Tether et al. (2002) compared innovation in services and manufacturing and found three core findings including that:

- Service firms were less innovative and less R&D intensive than manufacturing firms of the same size,
- Product improvements were more important than cost reductions indicating that service firms focused more on product innovation and,
- Training, acquisition of machinery and equipment and external technologies rated higher in importance.

One of the limitations of this approach, as argued by Tether *et al.*(2002), is that the service oriented approaches were developed primarily in the context of Knowledge Intensive Business Services (KIBS). KIBS are a specialized group of services which rely on client-intensive relationships and co-production of services. Interestingly, even key authors in this area such as Gallouj (2004,) Sundbo (2000), and den Hertog (2000) have indicated that not all services would exhibit these characteristics and that the actual pattern of innovation in services is much more diversified.

## 2.3 The 'Integrative' perspective

The final approach to service innovation is the "integrative" approach (Gallouj, 2002). This approach moves beyond the manufacturing and services dichotomy and emphasizes the blurring of the boundaries between services and manufacturing industries. In this approach, there is increasing recognition that the two sectors are increasingly integrated - with manufacturing taking on service activities and vice versa. More recently, a study by (Howells 2001) presents findings that demonstrate that:

- services are becoming more R&D intensive,
- service firms are becoming more innovative and
- manufacturing firms are taking on more non-technological innovation activities as part of their activities.

Some authors such as Miles (2001) suggest that each industry may have its own combination of characteristics that are not clearly separable. Regardless, in spite of this more balanced or integrated approach, there is still an outstanding demand for improving our understanding that the role of services innovation can be both technology and non-technological in nature. The challenge remains for service innovation theory to develop a more complete perspective of the innovation process.

One attempt to pursue a more complete perspective is the "emergent/strategic positioning' perspective by Tether (2003). This perspective is related to, but extends beyond the integrative perspective discussed by Gallouj (2002) and highlights the importance of the strategic and competitive position of service firms. Specifically, Tether (2003) suggests that the different innovative trajectories that service firms pursue are influenced by the competitive position of the firm, the task environment in which they operate, and that service firms may use both 'hard' and 'soft' technologies for their innovations. Essentially, Tether's argument is that service firms can develop specific strategies to strategically position themselves and to facilitate entry and exit out of different market segments. He suggests that the strategies pursued by service firms "reflect the competitive process, as firms attempt to both shape their market and respond to the repositioning of rivals" (Tether 2003:484).While being positioned theoretically, however, this approach has not been developed in detail or tested empirically.

## 2.4 Summary and limitations of approaches

In spite of the growing interest in understanding innovation in the service sector, a comprehensive model for understanding service innovation is still lacking. One contributing factor has been the relative paucity of empirical and in-depth analysis of service innovation until the 1990s. Even with increased attention to service industries, a further problem, as Howells (2006) notes, is that information pertaining to service sector innovation is based on a small and fragmented corpus of researchers. Moreover, it is also worth noting that although the theoretical

underpinning of service innovation can be presented as evolutionary phases, it is important to recognize that research continues to be undertaken in all areas.

The above discussion provides a general overview of the approaches taken to understanding service innovation. In moving from the technological (traditional) perspective to the service-oriented, to the integrative and emergent/strategic positioning perspectives increased attention has been paid to the need to understand and account for the heterogeneity within and across service industry sectors. What is missing from the above approaches, however, is the ability to determine where these differences lie and how general differences in services and manufacturing innovation can be distinguished.

One means for addressing this, is to develop indicators that can more clearly define the service innovation. The following section will briefly discuss the work done on the role of intellectual property rights in relation to services innovation. Some of the works cited will resonate with the above discussion, although our aim is not to attempt to establish a direct fit.

## 3 Intellectual property rights as a service innovation indicator: Empirical foundation

While there are any number of innovation indicators that can be used to assess service firm performance, our interest in this section is directly related to the use of intellectual property rights as a means by which service firms can protect and appropriate the benefits from their innovations. The use of specific intellectual property mechanisms reflect the decisions being made by a firm to protect and benefit from their investments in innovative activities. The types of intellectual property mechanisms used by firms include both formal and informal methods. Formal methods include patents, trademarks, registration of design, copyright, and confidentiality agreements while informal methods (sometimes called strategic methods) include being first to market to gain a lead-time advantage, secrecy, and design complexity.

Similar to the trajectory for theoretical development, the use of intellectual property rights as an indicator for innovation has focused almost exclusively on patenting in the manufacturing sector. However, in contrast to manufacturing, it has been widely recognized, however, that service firms generally do not patent (Andersen and Howells 2000; Howells 2001) Regardless, to maintain a competitive advantage service firms need to be able to protect and appropriate returns for their innovations.

In line with the "service-oriented" (Lille school) perspective on innovation, it was widely believed that since service product innovations were intangible in nature they would not be able to rely on more formal methods of intellectual property protection to protect their innovative activities. Informal methods were posited as being more appropriate to the dynamics and characteristics of service firms, for instance, keeping information secret. Moreover, these methods were more familiar, cheaper, and consumed much less time and effort to monitor than more formal methods. In addition, research on small and medium sized enterprises (the predominant firm size for service industry firms) by Kitching and Blackburn (1999) demonstrate the strategies undertaken by small and medium enterprises (SMEs) were more likely to use informal IP protection methods.

If service firms were to use formal intellectual property mechanisms, it was believed that they would use copyright, primarily in the area of software production. However, according to Miles *et al.* (2000), among others, it was believed that since copyright system(s) in various countries offer weaker protection than more formal methods, innovative service firms would be more likely to choose other strategies, in particular, informal intellectual property protection methods to protect their IP and core knowledge base (Andersen and Howells 2000).

Results from several different studies, however, have presented a variety of different results in the use of intellectual property mechanisms by service industry sectors. In their study of KIBS, for example, Miles *et al.* (2000) compared the individual use of IP methods for three different service industry sectors including accountancy, architecture, and environmental engineering. These authors derive some interesting results in so far as demonstrating the scale of differences for each IP method use across sectors and within sectors, according to firm size. Using the 1996 Statistics Canada Survey of Innovation in Services, Baldwin *et al.* (1998) looked at three dynamic service sector industries including financial services, communications industries, and technical business service providers. The authors found

that various forms of intellectual property protection were used in accordance with the difference in the innovation regimes used by each sector.

More recently, the CIS3 study has introduced services as part of their large-scale innovation analysis efforts. In analysing the CIS3 survey, the OECD (2005a) highlights the limited but growing role of IP in service sector innovation especially in terms of using more formal mechanisms such as patents, trademarks, and copyright. The analysis further reported that service firms were "relying on formal and strategic methods of protecting their IP, although less so than manufacturing firms" (2005:31,32). Further analysis suggested that different mechanisms for protecting IP varied considerably across service sector industries.

The mixed results from the above studies demonstrate the continuing complexity for understanding the dynamics of service innovation and the heterogeneity within and across service sectors. We argue, however, that one of the limitations of the above approaches as providing a means for addressing service innovation is based on the fact that these studies have examined and compared the use of intellectual property rights on the basis of the individual IP mechanisms. The results have been, as described above, descriptions of highly variegated IP strategies used within and across service industry sectors.

In spite of this, suggestions have been put forth, although not developed, which identify that the conflicting results may be the result of different IP strategies across sectors. For instance, in addition to identifying the considerable variation in the use of different IP instruments according to innovation regime, Baldwin *et al.* (1998) point out that it is the composition of different IP mechanisms that matter and it is this composition that helps to increase a firms' competitive advantage over rivals. Similarly, in their study of knowledge intensive business services, Miles *et al.* (2000:102) note that services firms "may need to determine which combination of IPR protection is most appropriate", particularly when they are faced with the decision of how to protect their knowledge assets. These above suggestions point to the need for a conceptual framework that can capture these differences in firm strategies for choosing a particular set of IP methods that reflects the particular service industry sector it operates in.

## 4 Conceptual framework and research questions

This is an exploratory study that seeks to identify the relationship between innovation and intellectual property protection in service firms. As noted above, one of the limitations of previous attempts to use intellectual property as an indicator of services innovation is based on the fact that intellectual property mechanisms tend to be analysed at the individual IP method level, e.g. patents, trademarks, lead-time advantage. These individual results are then compared across sectors and/or each method used for each sector is outlined. As discussed above, any conceptual framework exploring the innovation profile of services innovation needs to take into account the differences in the innovation profile of service sectors both across and within sectors. These detailed characteristics are currently not being captured through the analysis of individual intellectual property mechanisms.

### 4.1 Intellectual property regime

In establishing the difference in the profile of the use of IP mechanisms for the French service sector industries in the CIS3 survey, Mairesse and Mohnen (2004:231) found a clear separation between the use of formal intellectual property protection methods - patents, trademarks, and registration of design – and all other IP mechanisms, informal methods, for both manufacturing and services industries. Similar results were also found in other empirical studies in the manufacturing industry sectors. Cohen *et al.* (2000) found sharp differences between firms that used legal appropriability mechanisms (patents, trademarks, and registration of design) and those that used informal mechanisms (secrecy, lead-time advantage, complexity of design). In a study of legal versus first mover strategies for manufacturing firms, Laursen and Salter (2005) found that firms with high innovative performance used either a legal appropriability strategy or a first mover strategy and that those firms that used both had a lower level of innovative performance. In other words, each strategy was a substitute for the other.

Drawing on the above approaches, we propose to distinguish between *formal* and *informal only* intellectual property protection mechanisms being used to support innovation. Hereinafter, the authors refer to each composition of IP

methods –as the *formal IP regime* and the *informal IP regime*. The term regime is derived from that used by Krasner (1982) to describe the "principles, norms, rules, and decision making procedures around which actors expectations convergence in a given issue-area". The notion of a regime is based on the idea that the creation of a regime alters the types of actions taken between the environment and the behaviour of the actors. In other words, regimes describe the establishment of specific practices as ongoing patterns of behaviour in a particular setting. We use the term IP regime, therefore to denote that the use of IP is not limited to a choice of mutually exclusive intellectual property methods but reflects a combination of elements designed to establish a competitive advantage for the service firm.

The term formal IP regime is used in this study to describe those firms using formal IP methods and the term informal IP regime is use to describe those firm using informal IP methods only. Those firms that use formal methods can also use informal, so the distinction that is used in this paper is between those firms that use formal (and possibly informal as well) and those that use informal only.

For the purpose of this study, IP methods have been divided into two categories, informal and formal.

- Formal IP methods include patents, trademarks and registration of industrial design.[2]
- Informal methods include secrecy, complexity of design and lead-time advantage on competitors.

The data for this study is drawn from a large-scale survey of selected service industries in Canada, and is described in greater detail below. All firms in the survey were asked to the methods that they used to protect their intellectual property. A test for significance[3] compared the methods used by innovative exporters (which will be analysed in this study) and, no significant difference between the use of informal methods by firms with formal regimes and informal regimes (Table 1) was found. This suggests the level of use of informal methods by innovative exporters is basically the same, but there is a differentiation in regards to their use of formal methods.

2 To maintain a clear distinction between formal and informal intellectual property regimes we defined formal intellectual property regimes as comprising those mechanisms requiring some form of registration that would create legal rights and sanctions for their infringement. Copyright was excluded from analysis since it is not subject to a formal registration process, therefore, does not generate economic statistics. Copyright also does not provide formal disclosure of information pertaining to what innovations are being developed. As Miles et al. (2000) point out, copyright "centres on protecting creativity for subsequent appropriation rather than diffusing knowledge" and is only activated when a firm sees an infraction. Confidentiality agreements also were excluded from the study since, as above, they do not require registration and does not diffuse knowledge. Second, confidentiality agreements tend to be used in many sectors, as part of a service firm's routine business practices and are not necessarily related to innovation processes undertaken by the firm (Blind et al., 2003:40).

3 Two estimates are significantly different at the 95% confidence level if ($p < 0.05$). When the estimate is shaded, this indicates that it is statistically significantly higher than the estimate to which it is being compared. No shading indicates that there is no significant difference between the two estimates.

**Table 1**
**Use of intellectual property methods by innovative exporting firms, by intellectual property regime and by intellectual property method[1]**

| | Formal intellectual property methods | Informal intellectual property methods |
|---|---|---|
| | percentage | |
| **Information and communication technologies** | | |
| **Formal methods** | | |
| Patents | 33.6 E | 0 |
| Registration of design | 22.6 E | 0 |
| Trademarks | 86.9 E | 0 |
| **Informal methods** | | |
| Secrecy | 68.9 E | 68.1 E |
| Complexity of design | 51.2 E | 41.6 E |
| Lead time advantage on competitors | 77.0 E | 81.9 E |
| **Selected professional, scientific and technical services** | | |
| **Formal methods** | | |
| Patents | 72.8 E | 0 |
| Registration of design | 28.6 E | 0 |
| Trademarks | 72.4 E | 0 |
| **Informal methods** | | |
| Secrecy | 79.9 E | 66.3 E |
| Complexity of design | 44.1 E | 54.4 E |
| Lead time advantage on competitors | 75.8 E | 66.1 E |

1 All estimates in the paper are weighted up to total population. The reliability of each estimate has been calculated. All estimates that are presented are either "very reliable" or "reliable" except in cases that are indicated by "E" where they are to be used with caution.
**Source(s)**: Statistics Canada, Survey of Innovation 2003.

## 4.2 Intellectual property regime and innovation profile of service firms

The issue of whether the distinction in IP regime can help identify the factors that influence service innovation within and across service industry sectors is also an issue of interest for this study. As discussed above, however, prior studies in the area of innovation which have sought to establish taxonomic profiles of firms (the technological approach) or which have focused on the service-manufacturing dichotomy (service-oriented approach), have demonstrated that a continuum of characteristics can apply to each service and/or manufacturing industry. Broadly speaking, the limitations of these approaches has been that they either aggregate services to a level of homogeneity across sectors, or introduce multiplicity of modes that require extensive data to identify their various combinations thereby reducing the ability to ascertain comparative or generalizable results.

In line with this view and to further develop the conceptual framework for examining services innovation, we draw on recent work being done by strategic management scholars who point out that firms use intellectual property not only to protect their investments but also to help develop strong competitive positions. In this regard, intellectual property rights, or "appropriability mechanisms" are part of a firm's strategy to gain competitive advantages from their investments (Rumelt 1984; Teece 1986; Cohen, Nelson, and Walsh 2000). Further, in the context of service innovation, Blind *et al.* (2003) note that IPR strategies for innovative service firms can be linked to the wider development of the strategic assets and core competencies of firms, as discussed by Winter (1987) and Prahalad and Hamel (1990).

In an effort to address the numerous factors that can influence service firm innovation at the level of the firm, we also propose to take into account the "emergent/strategic positioning" perspective of service innovation discussed in Section 2 above which suggests that the different innovative trajectories that service firms pursue are influenced by the competitive position of the firm, the task environment in which they operate, and the fact that service firms may use both 'hard' and 'soft' technologies for their innovations (Tether, 2003).

What is important to draw from this latter perspective is the need for understanding the influence of the external environment as an influence on firm innovative performance. This external market environment is most likely to influence the strategic decisions made by firms, in particular the strategies used to protect and appropriate the returns from their investments in innovative activities. The importance of market-related activities to some service activities was also pointed out by Sundbo and Gallouj (2000), but not explored further.

To capture these dynamics, the authors argue that an examination of both the internal and external factors influencing the use of IP regime choice within and across service sector industries is necessary to better understand use of IP regime by service firms. Internal variables include firm-specific characteristics and the different types of innovative activities service firms engage in, while the external environmental factors include firm strategy variables and the industry context that a firm operates in. The indicators for each are:

- Firm-specific characteristics. The first set of variables refers to firm-specific variables that deal with the structural characteristics of firms and their influence IP use. These variables have been seen in previous innovation studies, albeit primarily manufacturing, as influencing firm behaviour and have been part of the discussion of service sector industries. The variables considered for this study include firm size, country of control, and human capital in terms of skilled labour (R&D Personnel) and highly educated workers (university graduates).

- Firm-Specific Innovation Activities. As highlighted above, service sector firms can pursue highly variegated innovation trajectories and the nature of innovation can differ. Firm-specific innovation activities under consideration in this study include the level of investment made in innovation, the type of innovation being done, R&D activities, the sources of information used by service sector firms and innovation collaboration.

- Firm Strategy Variables. Firm strategy variables provide an indication of the reasons firms may have for focusing their activities on particular market segments. The variables considered here are the factors contributing to the success of a firm, and whether or not government programs are being used to support these activities.

- External Market Variables. External market variables shed light on the type of market that a firm operates in. The variable examined includes the novelty of an innovation, whether a firm is participating in a niche or specialized market, export intensity, and intensity of commercialization.

This leads us to the second research question: Will the type of IP regime help identify distinctive characteristics both internal and external to the firm that influence use of IP regime of service firms in export markets?

## 5 Data and methodology

The empirical analysis for this study is based on the Statistics Canada's Survey of Innovation 2003 which surveyed establishments in selected service industries.[4] Innovative exporters were selected as the subpopulation to be analysed. As already noted above, previous empirical investigations have demonstrated that there tends to be less demand for the use of intellectual property rights by service firms more generally. Therefore, in order to create a representative sample of IP use for service industry sectors, our purpose was to define and examine those service industry sectors and types of firms that were most likely to use intellectual property mechanisms. Mairesse (2004: 231) found in his study of the French CIS3 survey, that innovating firms use all types of protection mechanism more intensively than non-innovating firms. Innovating firms create new knowledge and are therefore more likely to use some intellectual property regime in order to appropriate the benefits from innovation than those firms that do not innovate.

4 Details of the methodology of the survey can be found on Statistics Canada's website http //www statcan ca/cgibin/imdb/p2SV pl?Function=getSurvey&SDDS=4218&lang=en&db=IMDB&dbg=f&adm=8&dis=2 The statistical unit of the survey is the establishment The establishment is the level at which the accounting data required to measure production is available (principal inputs, revenues, salaries and wages) The establishment, as a statistical unit, is defined as the most homogeneous unit of production for which the business maintains accounting records from which it is possible to assemble all the data elements required to compile the full structure of the gross value of production (total sales or shipments, and inventories), the cost of materials and services, and labour and capital used in production In the text that follows the term "firm" will be used instead of the statistics term 'establishment"

The definition of innovators used in this study is based on the guidelines in the Oslo Manual (OECD/EUROSTAT, 1997). For the Survey of Innovation 2003, innovative firms are those that, during the period 2001 to 2003, introduced a new or significantly improved product (good or service) or a new or significantly improved process (including improved ways of delivering goods or services).

Firms from two service industry groups that were surveyed by the Survey of Innovation 2003 were selected: Information and Communication Technologies (ICT) and Selected Professional Scientific and Technical Services (Selected PST). These had been identified in a previous study of the same Survey of Innovation as exhibiting highly innovative behaviour (Earl, 2005). The ICT sector is defined as a special aggregation of North American Industry Classification System (NAICS) industries. This sector comprises industries primarily engaged in producing goods or services, or supplying technologies, used to process, transmit or receive information. Appendix A provides a list of the NAICS industries that comprise each of these two industry groups that will be analyzed in this paper. Table 2 presents the population and sample for each of the industry groups.

**Table 2**
**Population and sample of service industry groups, by number establishments**

| | Population | Sample |
|---|---|---|
| | number | |
| Information and communication technologies | 4,504 | 1,357 |
| Selected professional scientific and technical services | 4,356 | 1,371 |

**Source(s):** Statistics Canada, Survey of Innovation 2003.

The sub-population that will be analyzed is innovative exporting firms which have formal or informal IP regimes. Service firms operating in global markets are expected to have a stronger IP regime in place for two reasons. First, these firms will face a larger potential market than a national market and, second, international markets are expected to face higher levels of competition which will require firms to have a stronger IP regime in place. Exporting firms are those that generated revenues in 2003 from the sale of products to clients outside of Canada. As can be seen on Table 3, innovative exporters represent one half of the firms in the ICT group and 28% of firms in the PST group.

**Table 3**
**Percentage of innovative exporters of the total population in industry groups**

| | Innovative exporters |
|---|---|
| | percentage |
| Information and communication technologies | 51.7 E |
| Selected professional scientific and technical services | 28 |

**Source(s):** Statistics Canada, Survey of Innovation 2003.

All firms in the survey were asked to indicate the methods that they used to protect their intellectual property (IP) during the period 2001 to 2003. For the purpose of this study, IP methods have been divided into two categories, informal and formal.

- *Formal IP methods* include patents, trademarks and registration of industrial design.
- *Informal methods* include secrecy, complexity of design and lead-time advantage on competitors.

The term formal IP regime is used to describe those firms using formal methods. Firms that have formal IP regimes can also use informal methods. The term informal IP regime is used to describe those firms using informal methods only. Table 4 shows the percentage of firms using formal and informal regimes among the two industry groups. For both groups approximately 10% have neither the formal or informal IP regimes.

**Table 4**
**Percentage of innovative exporters, by type of intellectual property regime and industry group**

| | Innovative exporters |
|---|---|
| | percentage |
| **Information and communication technologies** | |
| Formal intellectual property regime | 54 E |
| Informal intellectual property regime | 36.8 E |
| Neither formal or informal intellectual property regime | 9.2 E |
| **Selected professional, scientific and technical services** | |
| Formal intellectual property regime | 45.7 E |
| Informal intellectual property regime | 45.6 E |
| Neither formal or informal intellectual property regime | 8.7 E |

**Source(s):** Statistics Canada, Survey of Innovation 2003.

## 6 Results

This section will compare innovative exporters with formal IP regimes and those with informal IP regimes.

Four types of variables will be examined:

- firm characteristics;
- firm innovative activities;
- firm strategy; and
- firm market environment.

The analysis in this section will examine, for any particular variable, whether firms with formal IP regimes are significantly different from firms with informal IP regimes.

### 6.1 Firm characteristics

Firms can be differentiated from one another based on basic structural differences. The structural differences that will be examined in this sub-section are: firm size, country of control and knowledge capability.

Larger firms in the ICT group are more likely to have formal IP regimes as measured by the percentage of firms with 100 employees or more (Table 5). One quarter of the innovative exporters using formal IP regimes are larger firms. By contrast, firm size was not a factor for distinguishing firms using formal and informal IP regimes for selected PST innovative exporters. Approximately one in five firms with formal and informal IP regimes were larger firms.

**Table 5**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and firm size**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| 100 employees or more | 26.5 E,* | 4 |
| **Selected professional, scientific and technical services** | | |
| 100 employees or more | 19.7 E | 17.4 |

* Significantly different at the 95% confidence level if (p > 05).
**Source(s):** Statistics Canada, Survey of Innovation 2003

Table 6, shows that a large majority of firms in both industry groups were Canadian controlled. Firms with formal and informal IP regimes for both industry groups were both as likely to be Canadian controlled.

**Table 6**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and country of control**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| Firms that are Canadian controlled | 87.6 E | 96.9 |
| **Selected professional, scientific and technical services** | | |
| Establishments that are Canadian controlled | 92.5 | 95.4 |

**Source(s):** Statistics Canada, Survey of Innovation 2003

Innovative firms in the two service industry groups that are being analysed can be expected to rely on the development of its human capital assets. Two indicators of human capital assets are analysed including university graduates and R&D personnel. For the ICT sector, there is a significant difference between firms using of formal and informal IP regimes in terms of the percentage of firms with more than 50% of their employees having university graduates in 2003 (Table 7). However there is no similar significant difference for the selected PST Group. A relatively high percentage of firms with both types of regimes have more that 50% of their employees who are university graduates.

**Table 7**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and percentage of university graduates**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| With more than 50% university graduates | 82.7 E * | 52.1 E |
| **Selected professional, scientific and technical services** | | |
| With more than 50% university graduates | 69.7 E | 74.2 E |

* Significantly different at the 95% confidence level if ($p > .05$).
**Source(s):** Statistics Canada, Survey of Innovation 2003.

There is, however, a significant difference between innovative exporters in both industry groups having formal or informal IP regimes in terms of their personnel who are involved in R&D activities (Table 8). For both service sector industry groups, a significantly higher percentage of innovative exporters with formal IP regimes have more than 25% of their full-time employees involved in R&D activities in 2003 than do those with informal IP regimes.

**Table 8**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and percentage of research and development personnel**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| With more than 25% R&D personnel | 60.0 E * | 21.7 E |
| **Selected professional, scientific and technical services** | | |
| With more than 25% R&D personnel | 53.2 E * | 30.9 E |

* Significantly different at the 95% confidence level if ($p > .05$).
**Source(s):** Statistics Canada, Survey of Innovation 2003.

The comparison of the firm characteristics of innovative exporters using formal and informal IP regimes shows that only one of the four characteristics examined was found not to be significant distinguishing characteristic for both industry groups, namely country of control. The other three characteristics (size, percentage of university graduates and percentage of R&D personnel) were all found to be significantly different for ICT firms that had formal IP regimes than those that had informal IP. However, this is not the case for the selected PST industry groups. For this industry group the only significantly different characteristic is the percentage of firms with more than 25% of their personnel who are R&D personnel.

## 6.2 Firm innovative activities and intellectual property regime

This sub-section examines the relationship between the types of innovative activities undertaken by innovative exporters and the type of IP regime they have. When carrying out innovative activities, firms rely on their internal capabilities but they also draw on resources outside of the firm in what is often referred to as the innovation system. This section will examine first those innovation activities that are internal to the firms and then examine the resources for innovation that service firms draw on from outside the firm.

### 6.2.1 Internal innovation activities

Five internal innovative activities are considered in this sub-section:

- investment in innovation,
- the type of innovation,
- R&D activities,
- internal sources of information and
- innovation collaboration.

For innovative exporters in the select PST services, there is a significant difference in between formal and informal IP regimes in terms of the percentage of expenditures going to innovation activities. There is no significant difference for information and communication technologies (ICT). Innovative exporters with formal IP regimes in the selected PST services are more likely to invest more than 25% of their total expenditures on innovative activities than those that have informal IP regimes. (Table 9).

**Table 9**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and percentage of expenditures on innovation activities**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| With 25% or more of total expenditures on innovation activities | 54.9 E | 33.2 E |
| **Selected professional, scientific and technical services** | | |
| With 25% or more of total expenditures on innovation activities | 34.1 E * | 12.4 E |

* Significantly different at the 95% confidence level if ($p > .05$)
**Source(s):** Statistics Canada, Survey of Innovation 2003

Innovative exporting firms can undertake innovation by developing new or significantly improved products or processes. Table 10 shows that innovative exporters with formal IP regimes in the ICT industry group are more likely to be product innovators and are less likely to do process only innovations than those with informal IP regimes. This contrasts with selected PST innovative exporters where there is no significant difference between firms with formal IP regimes when compared with informal IP regimes.

**Table 10**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and type of innovation**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| With product innovations | 98.9 * | 88.1 E |
| With process only innovations | 1.1 | 1.9 E * |
| **Selected professional, scientific and technical services** | | |
| With product innovations | 91.2 | 89.4 E |
| With process only innovations | 8.8 | 10.6 E |

* Significantly different at the 95% confidence level if (p > 05)
**Source(s):** Statistics Canada, Survey of Innovation 2003

Table 11 shows that there is a significant difference between innovative exporters with formal and those with informal IP regimes. In both industry groups, innovative exporters with formal IP regimes are more likely to be carrying out internal R&D than those with informal IP regimes. Approximately 20% of innovative firms with informal IP regimes in both industry groups indicated that they did not undertake internal R&D.

**Table 11**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and performance of internal research and development**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| Carrying out internal research and development | 97.2 * | 80.9 E |
| **Selected professional, scientific and technical services** | | |
| Carrying out internal research and development | 94.8 * | 78.9 E |

* Significantly different at the 95% confidence level if (p > 05)
**Source(s):** Statistics Canada, Survey of Innovation 2003

Inside the firm there are important sources of information that can play an important role in suggesting or contributing to innovation. Service firms were asked to indicate the importance of the various internal sources including: R&D staff, sales and marketing staff, production staff, management staff and other business units in their firms. Among these various sources, only R&D staff was found to be a significantly different important source when formal and informal IP regimes were compared (Table 12). Eighty-two percent of innovative exporting firms with formal IP regimes in ICT and sixty in PST consider R&D staff to be an important source of information.

**Table 12**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and internal sources of information**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| Research and development staff | 82.4 * | 54.6 E |
| **Selected professional, scientific and technical services** | | |
| Research and development staff | 60.2 * | 36.0 E |

* Significantly different at the 95% confidence level if (p > 05)
**Source(s):** Statistics Canada, Survey of Innovation 2003.

### 6.2.2 External innovation activities

Innovative firms can rely only on their internal resources in order to carry out innovative activities or they can extend their search for resources to undertake innovative activities externally through their interactions with other actors in the economy. This sub-section will examine three external innovation activities that firms can engage in:

- external R&D
- external source of information on innovation, and
- collaborative innovation projects.

In both industry groups, innovative exporters with formal IP regimes are more likely to carry out external R&D than are those with informal IP regimes (Table 13). For innovative exporters with formal IP regimes in ICT, nearly thirty-nine percent carried out external R&D and for selected PST two thirds did.

**Table 13**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and performance of external research and development**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| Carrying out external research and development | 38.5 E * | 17.9 E |
| **Selected professional, scientific and technical services** | | |
| Carrying out external research and development | 62.5 E * | 35.3 E |

* Significantly different at the 95% confidence level if (p > 05)
**Source(s):** Statistics Canada, Survey of Innovation 2003

The Survey of Innovation 2003 asked firms to indicate the degree of importance of twelve possible external sources of information needed for suggesting or contributing to innovation, including clients, suppliers, public research organizations, and competitors. Among these various possible sources of information only the four presented on Table 14 were shown to be significantly different when the formal and informal IP regimes of innovative exporters were compared. In the ICT industry group, innovative exporters with formal IP regimes were more likely to use consultancy firms as external sources of information than those with informal IP regimes. In the selected PST industry group, trade fairs and exhibitions and trade associations as well as competitors and other enterprises in

the same industry were more likely to be external sources of information for innovative exporters with formal IP regimes than those with informal IP regimes.

**Table 14**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and external sources of information**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| Consultancy firms | 14.1 E * | 2.3 E |
| Competitors and other enterprises in the same industry | 30.9 E | 22.4 E |
| Trade fairs and exhibitions | 37.5 E | 44.7 E |
| Trade associations | 25.7 E | 20.0 E |
| **Selected professional, scientific and technical services** | | |
| Consultancy firms | 21.7 E | 12.2 E |
| Competitors and other enterprises in the same industry | 45.1 E * | 25.0 E |
| Trade fairs and exhibitions | 55.1 E * | 29.2 E |
| Trade associations | 41.0 E * | 15.5 E |

* Significantly different at the 95% confidence level if (p > 05)
**Source(s):** Statistics Canada, Survey of Innovation 2003

Collaborative innovation projects are more likely to be carried out by innovative exporters in the ICT industry group with formal IP regimes than those with informal IP regimes (Table 15). Approximately four of five innovative exporters in ICT were involved in collaborative projects with external partners during the period 2001 to 2003. For selected PST services, there is no significant difference.

**Table 15**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and percentage involved in innovation collaboration**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| Collaborating on innovation projects | 61.6 E * | 31.4 E |
| **Selected professional, scientific and technical services** | | |
| Collaborating on innovation projects | 52.3 E | 41.0 E |

* Significantly different at the 95% confidence level if (p > 05)
**Source(s):** Statistics Canada, Survey of Innovation 2003

Through government support programs for innovation, governments provide support of a firm's innovative activities. Table 16 shows that, for the most part, the percentage of innovative exporters with formal versus informal IP regimes using of government support programs is not significantly different. The exceptions are the use of government venture capital support and the use of government technology support and assist programs by innovative exporters with formal IP regimes in selected PST firms with approximately sixteen (15.8%) percent using government venture support programs and one quarter of firms using government support and assistance programs.

**Table 16**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and use of government programs**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| Research and development tax credits | 63.9 E | 40.5 E |
| Government research and development grants | 9.5 E | 4.3 E |
| Government venture capital support | 2.3 E | 4.8 E |
| Government technology support and assistance programs | 9.9 E | 7.8 E |
| **Selected professional, scientific and technical services** | | |
| Research and development tax credits | 60.5 E | 41.5 E |
| Government research and development grants | 26.2 E | 15.4 E |
| Government venture capital support | 15.8 E * | 2.8 E |
| Government technology support and assistance programs | 27.1 E * | 7.6 E |

* Significantly different at the 95% confidence level if (p > 05)
**Source(s)**: Statistics Canada, Survey of Innovation 2003

Of the firm innovation characteristics that were examined, significant differences were found between innovative exporters with formal IP regimes when compared to those with informal IP regimes. Innovator exporters with formal IP regimes were more likely to undertake R&D activities (both internal and external) and were more likely to use R&D staff as a source of information for innovation. However, there were some characteristics that were significantly different for one of the industry groups and not the other. ICT innovative exporters with formal IP regimes were more likely to use consultancy firms as a source of information, were more likely to be product innovators, were less likely to be process only innovators and were more likely to be involved in innovation collaboration with external partners. Selected PST innovative exporters with formal IP regimes were more likely to use trade fairs and exhibitions and trade associations as well as competitors and other enterprises in the same industry as sources of information, were also more likely to use two specific government programs were more likely to invest in innovation activities than were those with informal IP regimes.

## 6.3 Firm strategy

The Survey of Innovation 2003 asked firms to indicate the importance of twenty-three success factors that could contribute to the success of the firm. These factors were classified under four categories: markets and products, human resources, knowledge management and other. A significant difference was found between innovative exporters with formal IP regimes and those with informal IP regimes for the three factors shown on Table 17. For both industry groups, innovative exporters with formal IP regimes were significantly more likely to indicate that "developing export market" was an important success factor than for those with informal IP regimes. In addition, innovative exporters in selected PST with informal IP regimes were more likely to indicate one of the knowledge management indicators, "Encouraging experience workers to transfer their knowledge to new or less experienced workers" than those with formal IP regimes. "Encouraging risk taking initiative by employees" was more likely to be indicated as an important success factor of innovative exporters with formal IP regimes in the selected PST industry group than those with informal IP regimes.

**Table 17**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and firm success factors**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| Developing export markets | 60.6 E,* | 32.3 E |
| Encouraging experienced workers to transfer their knowledge to new or less experienced workers | 79.1 E | 61.4 E |
| Encouraging risk taking initiatives by employees | 54.8 E | 39 E |
| **Selected professional, scientific and technical services** | | |
| Developing export markets | 64.8 E,* | 36.2 E |
| Encouraging experienced workers to transfer their knowledge to new or less experienced workers | 80.1 E | 93.5 E,* |
| Encouraging risk taking initiative by employees | 51.7 E,* | 29.7 E |

* Significantly different at the 95% confidence level if (p > 05)
**Source(s):** Statistics Canada, Survey of Innovation 2003

## 6.4 Firm market environment

The market that firms operate in provides an indication of the state of competition that service firms face in exporting markets as well as the risks faced by firms. Four market environment variables will be examined in this section: development of niche or specialized markets, novelty of innovation, export intensity and the intensity of commercialization of innovation.

The development of niche or specialized markets provides insights into the types of products/service offerings that firms are offering in the markets they are operating in. Firms were asked if the development of niche or specialized markets were important success factors Table 18 shows that there is no significant difference between innovative exporters with formal and informal IP regimes for both industry groups. A very large percentage of both industry groups, greater than two-thirds of the innovative exporters for both groups considered developing niche or specialized markets to be important to their firm's success.

**Table 18**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and the development of niche or specialized markets**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| Development of niche or specialized markets is an important success factor | 69.4 E | 68.6 E |
| **Selected professional, scientific and technical services** | | |
| Development of niche or specialized markets is an important success factor | 70.2 E | 83.5 E |

**Source(s):** Statistics Canada, Survey of Innovation 2003

Novelty of innovation provides insight into the newness of the product innovations being introduced into the marketplace or the processes being implemented in the firm. World-first innovations refer to leading edge innovations that are the first of their kind in the world. World-first innovations are more radical in nature which

presents firms with higher risks such as market acceptance, but can provide the firm with a competitive advantage in the marketplace.

Table 19 shows that there is a statistically significant difference between ICT innovative exporters with formal and informal IP regimes with world first products and world first processes. The selected PST industry group did not show a statistically significant difference.

**Table 19**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and novelty of innovation**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| With world first product | 43.7 E * | 4.9 E |
| With world first process | 6.7 * | 1.6 |
| **Selected professional, scientific and technical services** | | |
| With world first product | 47.4 E | 25.3 E |
| With world first process | 18.3 E | 9.3 E |

* Significantly different at the 95% confidence level if (p > 05)
**Source(s):** Statistics Canada, Survey of Innovation 2003

Another question in the survey asks firms to indicate degree of novelty of their most innovative product or process on a scale of slightly new to totally new. Table 20 shows that innovative exporters in both industry groups with formal IP regimes are more likely to indicate that their most innovative product has a high degree of novelty. Two thirds of innovative exporters in ICT with formal IP regimes and one half of those in selected PST indicated that their most innovative product had a high degree of novelty.

**Table 20**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and novelty of most innovative product**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| Indicating high degree of novelty of most innovative product | 61.5 E * | 31.5 E |
| Indicating high degree of novelty of most innovative process | 23.6 E | 23.2 E |
| **Selected professional, scientific and technical services** | | |
| Indicating high degree of novelty of most innovative product | 54.2 E * | 26.9 E |
| Indicating high degree of novelty of most innovative process | 46.7 E | 29.1 E |

* Significantly different at the 95% confidence level if (p > 05)
**Source(s):** Statistics Canada, Survey of Innovation 2003

Table 21 shows the extent to which the innovative exporters are devoted to the export market. There is a significant difference between innovative exporters using formal and informal IP regimes for both ICT and selected PST industry groups. A significantly higher percentage of innovative exporters using formal IP regimes derived more than 50% of their revenue from their export market in 2003, two thirds of innovative exporters in for ICT and one half for select PST.

**Table 21**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and percentage revenues from exports**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| With more than 50% of revenues from exports in 2003 | 60.2 E * | 19.5 E |
| **Selected professional, scientific and technical services** | | |
| With more than 50% of revenues from exports in 2003 | 52.0 E * | 23.1 E |

* Significantly different at the 95% confidence level if ($p > 05$).
**Source(s):** Statistics Canada, Survey of Innovation 2003.

The intensity of commercialization of innovation is an indicator of how fast firms are introducing new products into the marketplace and of how fast firms need to innovate in order to remain competitive. Results on Table 22 do not show a significant difference between the percentages of innovative exporters with formal IP versus informal IP regime in either of the service industry groups.

**Table 22**
**Percentage of innovative exporters using formal and informal intellectual property regimes, by industry group and percentage revenues from innovative products**

| | Innovative exporters | |
|---|---|---|
| | Formal intellectual property regime | Informal intellectual property regime |
| | percentage | |
| **Information and communication technologies** | | |
| With 25% or more revenues for innovative products in 2003 from products introduced 2001 to 2003 | 64.6 E | 41.1 E |
| **Selected professional, scientific and technical services** | | |
| With 25% or more revenues for innovative products in 2003 from products introduced 2001 to 2003 | 38.8 E | 21.4 E |

**Source(s):** Statistics Canada, Survey of Innovation 2003.

Of the five market characteristics that were examined, a significant difference between innovative exporters with formal and informal IP regimes in both industry groups as related to their involvement in exporting was found and the novelty of the most innovative product. Innovative exporters with formal IP regimes are more likely to have more than 50% of their revenues from the export market. For the ICT industry group, innovative exporters with formal IP regimes are more likely as well to be developing world-first innovative products and processes for the marketplace than those with informal IP regimes. No significant difference was found between innovative exporters in both industries with formal or informal IP regimes in terms of the percentage of firms with 25% or more of their revenues from the introduction of innovative products in the three years examined by the survey.

## 7 Conclusion

Table 23 provides a summary of the characteristics between innovative exporters with formal vs. informal IP regimes for ICT and selected PST industry groups.

**Table 23**
**Significant difference between innovative exporters with formal versus informal intellectual property regimes for information and communication technologies and selected professional scientific and technical industry groups**

| | Information |
|---|---|
| **Firm characteristics** | |
| Size | Information and communication technologies only |
| Human capital – university graduates | Information and communication technologies only |
| Human capital – research and development personnel | Both industry groups |
| **Innovative activities** | |
| **Internal activities** | |
| Investment in innovation activities | Selected professional scientific and technical services only |
| Type of innovator - product | Information and communication technologies only |
| Type of innovator - process | Information and communication technologies only |
| Research and development activities – internal | Both industry groups |
| Research and development staff as source of innovation information | Both industry groups |
| **External activities** | |
| Research and development activities - external | Both industry groups |
| Consultancy firms as source of innovation information | Information and communication technologies only |
| Competitors and other enterprises in the same industry | Selected professional scientific and technical services only |
| Trade fairs and exhibitions as source of innovation information | Selected professional scientific and technical services only |
| Trade associations as source of innovation information | Selected professional scientific and technical services only |
| Innovation collaboration | Information and communication technologies only |
| Use of government venture capital support programs | Selected professional scientific and technical services groups |
| Use of government technology support and assistance programs | Selected professional scientific and technical services groups |
| **Firm strategy** | |
| Developing export markets as a success factor | Both industry groups |
| Encouraging experienced workers to transfer their knowledge to new or less experienced workers | Selected professional scientific and technical services only |
| Encouraging risk taking initiatives by employees | Selected professional scientific and technical services only |
| **Market characteristics** | |
| World first products | Information and communication technologies only |
| World first processes | Information and communication technologies only |
| Most innovative product has a high degree of novelty | Both industry groups |
| More than 50% of revenues from exports | Both industry groups |

This study has found that significant differences exist between innovative exporters using formal IP regimes and those using informal IP regimes which can be summarized in the following manner. In the most general terms, innovative exporters with formal IP regimes have a greater commitment to R&D activities and to export activities. In terms of R&D, they are more likely to have R&D personnel, to carry out both internal and external R&D activities, to use R&D staff as a source of information. In terms of exporter activities, they are more likely to have more than 50% of their revenues from exports and they consider the development export market as an important factor in the success of their firm. The most innovative of the innovator exporter products with formal IP regimes are considered to be of higher novelty than the most innovative products of those with informal IP regimes. This can perhaps be explained by the greater investment in R&D. This more novel could improve the competitive advantage of the firm in the marketplace.

The changing composition of OECD economies and the rapid growth of trade in services has placed the role of services and services innovation into innovation policy debates. In spite of the increased attention, the complexity of services innovation and the heterogeneity of services existing empirical evidence and theoretical frameworks remain largely underdeveloped. The objective of this paper was to examine the relationship between intellectual property rights and firm performance in service industry sectors. The authors used innovative exporting firms as the unit of analysis for two dynamic service industry sectors, Information and Communication Technologies and Selected Professional Scientific and Technical.

Rather than focusing on firms' efforts to leverage different intellectual property rights in service industry sectors, the authors introduce the concept of formal and informal IP regimes as a means to examine the similarities and differences within and across service industry sectors. To further our analysis, the authors also sought to identify the internal and external variables that would influence the use of IP regime for these two service industry sectors. By comparing the significant difference between the use of formal and informal IP regimes in terms of two service sector industries this study addresses the major weakness associated with identifying sectoral variations within and across service industry sectors.

The results of our study has demonstrated the usefulness of utilizing the concept of an IP regime, a bundle of IP practices, to explain similarities and differences within and across service industry sectors. In particular, this concept was applied to four areas that could influence firm competitive advantage: firm characteristics, innovative activities (internal and external to the firm), firm strategy, and firm market characteristics. In most cases we could establish a significant difference in terms of use of IP regime and the internal and external characteristics of firms and could identify specific innovation profiles for the specific service industry sectors.

The results in these areas also were instrumental in identifying the role of external variables in influencing the use of IP regime in relation to firm performance for both ICT and selected PST service industry sectors. In particular, the results demonstrated that firms in the selected PST service industry sector face a highly competitive marketplace environment and significant differences in IP regime were found for those variables used to strategically position the service firms in global markets and facilitate the external searching activities. The ICT service industry sector appeared to be less influenced by external market conditions but focused their activities on ensuring leading-edge innovative product/service offerings.

Overall, this study draws attention to the increasing role of services in innovation processes and the need for innovation indicators that can address the technological and non-technological aspects of innovation that are becoming a part of manufacturing and services activities. The approach and conceptual framework proposed in this study has enabled us to discern similarities and differences within and across service industry sectors on the basis of the use of a particular IP regime, formal or informal. The results from this study make important empirical and theoretical contributions to the area of services innovation.

Empirically, the results have demonstrated the usefulness of bundling IP practices as a regime to differentiate the activities of service firm in selected service industry sectors. The results from this study also provide evidence that external market conditions influence IP regime use and that firms seek out specific markets. Future empirical research could further delineate whether firms are operating in niche markets or in standardized markets, and the influence this has on the use of IP regime. Another potential direction for research would seek to further refine how these IP regimes shape firm performance and, in particular, the managerial and firm related capabilities required to support these IP regimes.

These results also support the new theoretical directions being taken in the service innovation literature in the area of "integration" and "strategic positioning" approaches, as these areas remain under examined. Further research in this area could draw from and apply the concepts in the strategic management literature on strategic positioning to services firm activities. In particular, the work on strategic positioning by (Porter 1996; Venkatraman 1989; Zajac, Kraatz, and Bresser 2000) which highlights how competitive advantage can be achieved by a desired fit between: (i) the unique value proposition offered by the firm, (ii) the product-market segment(s) targeted; and, (iii) the set of distinctive value activities aligned with the value proposition, could begin to address the complementarities between the technological and other drivers of services innovation.

## 7.1 Limits of the study and areas for further research

The objective of this study was to establish similarities and differences within and across service industry sectors using the conceptual framework of formal and informal IP regimes. The findings for this study have provided a set of robust results demonstrating the important role played by both the international and external variables influencing IP regime use by selected service firms. To the best of our knowledge, this is the only study that uses innovation survey data on services to address issues pertaining to innovative exporters and the internal and external variables

influencing IP regime use. Future research could extend our exploratory investigation, to the extent possible, to provide for comparative data that could help substantiate and/or to draw out other variables influencing firm use of IP regimes for firm performance.

In addition, our results confirmed the diversity and heterogeneity across and within selected service industry sectors. Much greater knowledge, however, is needed about the level and extent of diversity in these sectors. The empirical work in this study is based on two aggregate selected service industry groups, Information and Communication Technologies (ICTs) and Selected Professional, Scientific and Technical Services (PST). While these two aggregate sectors comprise the fastest growing and largely innovation service industries sectors of the Canadian economy, some of the findings may be slightly different given the diversity that occurs within this aggregate category. A more in-depth analysis could examine subpopulations within these aggregate industry sectors, for example, environmental consulting, engineering consulting or software services to see if the conceptual framework holds. More importantly, this would enable us to further identify the similarities and differences within a subpopulation to a finer level of granularity.

The second limitation results from the unit of analysis for this study - innovative exporting service firms. Before choosing to use innovative exporting service firms, we first set out to see if we could determine a significant difference between innovative firms and innovative exporting firms. In this process, the authors were able to identify that there was a significant difference in the use of IP regime by service firms in domestic markets versus export markets. One will therefore need to exercise caution in interpreting and generalizing the results on a service industry sector basis as these results would appear to hold primarily for exporting service firms and not necessarily domestic service firms.

This finding, however, highlights the need to need to re-examine the role of exports in the globalization of service firms more generally. It also provides for new areas of research in two areas. The first would be to compare and contrast innovative service firms in domestic markets with service firms in export markets and, second, to compare exporting firms in similar service sector areas. These areas would help inform public policy debate on service innovation since it would appear, based on our results, that public policy will need to take into account the markets, domestic or international, where service firms are competing.

## Appendix A — NAICS Industries

**Text table 1**
**Selected services industrial groupings by North American Industry Classification System (NAICS) Code 2002**

| | NAICS | Population of innovative exporters | Exporters in industry |
|---|---|---|---|
| | | percentage | |
| **Information and communication technology services** [1] | | | |
| Computer and communications equipment and supplies wholesaler-distributors | 4173 | 12.9 | 59.9 |
| Office and store machinery and equipment wholesaler-distributors | 41791 | 1.5 | F |
| Software publishers | 5112 | 10.5 | 76.6 |
| Wired telecommunications carriers | 5171 | 1.1 | 33.7 |
| Wireless telecommunications carriers (except satellite) | 5172 | 0.4 | 23.4 |
| Telecommunications resellers | 5173 | 0.7 | F |
| Satellite telecommunications | 5174 | 0.5 | 77.9 |
| Cable and other program distribution | 5175 | 0.4 | 92.8 |
| Other telecommunications | 5179 | 0.2 | X |
| Internet service providers, Web search portals | 51811 | 3 | 60.5 |
| Data processing, hosting and related services | 5182 | 2 | X |
| Office machinery and equipment rental and leasing | 53242 | 0.2 | 50 |
| Computer systems design and related services | 54151 | 65.2 | 37.2 |
| Electronic and precision equipment repair and maintenance | 8112 | 1.7 | 39.3 |
| **Total information and communication technology services** | | **100** | ... |
| **Selected professional, scientific and technical services** | | | |
| Engineering services | 54133 | 40 | 53.5 |
| Geophysical surveying and mapping services | 54136 | 3.5 | 36.9 |
| Surveying and mapping (except geophysical) services | 54137 | 1.5 | 14.3 |
| Testing laboratories | 54138 | 5.3 | 50.7 |
| Industrial design services | 54142 | 1.8 | 50.3 |
| Management consulting services | 54161 | 18.4 | 27.1 |
| Environmental consulting services | 54162 | 5.4 | 63.1 |
| Other scientific and technical consulting services | 54169 | 5.4 | 48.6 |
| Research and development in the physical, engineering and life sciences | 54171 | 16.5 | 52.8 |
| Research and development in the social sciences and humanities | 54172 | 2.1 | 31.7 |
| **Total professional, scientific and professional services** | | **100** | ... |

1. The Information Communication Technology Services industries correspond to the OECD standard definition available on the Statistics Canada website www.statcan.ca. "X" indicates that the estimate is confidential and "F" indicates that the estimate is too unreliable to be published.

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## Appendix C — Catalogued publications

### Science, Technology and Innovation statistical publications

| | |
|---|---|
| 88-001-XIE | *Science statistics* |
| 88-003-XIE | *Innovation analysis bulletin* |
| 88-202-XIE | *Industrial research and development, intentions (with 2004 preliminary estimates and 2003 actual expenditures) (annual)* |
| 88-204-XIE | *Federal scientific activities (annual)* |
| 88F0006XIE | *Science, Innovation and Electronic Information Division working papers* |
| 88F0017MIE | *Science, Innovation and Electronic Information Division research papers* |

**88-001-X Volume 31 – 2007**

No. 1 Research and development (R&D) personnel in Canada, 1995 to 2004 (January)
No. 2 Estimates of total spending on research and development (R&D) in the health field in Canada, 1989 to 2006 (March)
No. 3 Biotechnology scientific activities in federal government departments and agencies, 2004/2005
No. 4 Estimation of research and development expenditures in the higher education sector, 2005/2006 (August)
No. 5 Scientific and Technological (S&T) activities of Provincial Governments and Provincial Research Organizations, 2001/2002 to 2005/2006 (October)
No. 6 Total intramural research and development expenditures (November)
No. 7 Federal government expenditures on scientific activities, 2007/2008 (intentions) (December)
No. 8 Gross domestic expenditure on research and development, 2007 intentions (December)

**88-001-X Volume 30 – 2006**

No. 1 Distribution of federal expenditures on science and technology, by province and territories, 2003/2004 (February)
No. 2 Biotechnology scientific activities in federal government departments and agencies, 2004/2005 (March)
No. 3 Estimates of total spending on research and development in the health field in Canada, 1988 to 2005 (May)
No. 4 Industrial Research and Development, 2002 to 2006 (August)
No. 5 Estimation of research and development expenditures in the higher education sector, 2004/2005 (August)
No. 6 Federal government expenditures on scientific activities, 2006/2007 (September)
No. 7 Total spending on research and development in Canada, 1990 to 2006, and provinces, 1990 to 2004 (September)
No. 8 Nature of Research and Development, 2000 to 2004 (December)
No. 9 Distribution of federal expenditures on science and technology by province and territories, 2004/2005 (December)

**88-001-X Volume 29 – 2005**

No. 1 Distribution of federal expenditures on science and technology by province and territories, 2002-2003 (January)
No. 2 Research and development (R&D) personnel in Canada, 1993 to 2002 (May)
No. 3 Biotechnology scientific activities in federal government departments and agencies, 2003-2004 (May)
No. 4 Industrial research and development, 2001 to 2005 (June)
No. 5 Estimates of total spending on research and development in the health field in Canada, 1988 to 2004 (July)
No. 6 Estimation of research and development expenditures in the higher education sector, 2003-04 (December)
No. 7 Federal government expenditures on scientific activities, 2005/2006p (December)
No. 8 Total spending on research and development in Canada, 1990 to 2005p, and provinces, 1990 to 2003 (December)

***88F0006XIE* Working papers – 2007**

No. 1 Innovativeness and Export Orientation Among Establishments in Knowledge-Intensive Business Services (KIBS), 2003 (April)
No. 2 Where Are the Scientists and Engineers? (April)
No. 3 Results from the Functional Foods and Nutraceuticals Survey - 2005 (May)
No. 4 Report on Interviews on the Commercialization of Innovation (July)
No. 5 Overview and Discussion of the Results of the Pilot Survey on Nanotechnology in Canada (August)
No. 6 Selected Results of the Biotechnology Use and Development Survey 2005 (December)
No. 7 Innovators, Non-innovators and Venture Firms: What Is the Nature of Firms in Research and Development Services Industries? (December)

***88F0006XIE* Working papers – 2006**

No. 1 Provincial distribution of federal expenditures and personnel on science and technology, 1997/1998 to 2003/2004 (April)
No. 2 Buying and selling research and development services, 1997 to 2002 (May)
No. 3 Characteristics of Growth Firms, 2004/2005 (May)
No. 4 Scientific and Technological Activities of Provincial Governments and Provincial Research Organizations, 2000/2001 to 2004/2005 (July)
No. 5 Scientific and Technological Activities of Provincial Governments and Provincial Research Organizations, 2000/2001 to 2004/2005 (July)
No. 6 Conceptualizing and Measuring Business Incubation (July)
No. 7 Characteristics of Business Incubation in Canada, 2005 (July)
No. 8 Size and Persistence of R&D Performance in Canadian Firms, 1994 to 2002 (August)
No. 9 Estimates of Canadian Research and Development Expenditures (GERD), Canada, 1995 to 2006, and by Province 1995 to 2004 (September)
No. 10 Are Small Businesses Positioning Themselves for Growth? A Comparative Look at the Use of Selected Management Practices by Firm Size (October)
No. 11 Survey of Intellectual Property Commercialization in the Higher Education Sector, 2004 (October)
No. 12 Provincial Distribution of Federal Expenditures and Personnel on Science and Technology (December

***88F0006XIE* Working papers – 2005**

No. 1 Federal government expenditures and personnel in the natural and social sciences, 1995/96 to 2004/05 (January)
No. 2 Provincial distribution of federal expenditures and personnel on science and technology, 1996-97 to 2002-03 (January)
No. 3 Industrial R&D statistics by region, 1994 to 2002 (January)
No. 4 Knowledge sharing succeeds: how selected service industries rated the importance of using knowledge management practices to their success (February)
No. 5 Characteristics of firms that grow from small to medium size: Industrial and geographic distribution of small high-growth firms (February)
No. 6 Summary: Joint Statistics Canada – University of Windsor workshop on intellectual property commercialization indicators, Windsor, November 2004 (March)
No. 7 Summary: Meeting on commercialization measurement, indicators, gaps and frameworks, Ottawa, December 2004 (March)
No. 8 Estimates of research and development personnel in Canada, 1979 to 2002 (May)
No. 9 Overview of the biotechnology use and development survey – 2003 (April)
No. 10 Access to financing capital by Canadian innovative biotechnology firms (April)
No. 11 Scientific and technological activities of provincial governments and provincial research organizations, 1995-96 to 2003-04 (September)
No. 12 Innovation in Information and Communication Technology (ICT) sector service industries: Results from the Survey of Innovation 2003 (October)
No. 13 Innovation in selected professional, scientific and technical services: Results from the Survey of Innovation 2003 (October)
No. 14 Innovation in selected transportation industries: Results from the Survey of Innovation 2003 (November)
No. 15 Innovation in selected industries serving the mining and forestry sectors: Results from the Survey of Innovation 2003 (November)
No. 16 Functional foods and nutraceuticals: The development of value-added food by Canadian firms (September)
No. 17 Industrial R&D statistics by region 1994 to 2003 (November)
No. 18 Survey of intellectual property commercialization in the higher education sector, 2003 (November)
No. 19 Estimation of research and development expenditures in the higher education sector, 2003-2004 (December)
No. 20 Estimates of Canadian research and development expenditures (GERD), Canada, 1994 to 2005, and by province 1994 to 2003 (December)